

Criteria for the stability of triple systems and their application to observations of multiple stars

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Abstract

Criteria for stability of triple systems are studied and compared with the results of numerical simulations obtained for model triple systems and observed multiple stars. The results for the stability analyses using two new criteria-those of Aarseth and of Valtonen et al.-agree with the simulation results in 98% of cases. Thus, these criteria can be used to analyze the stability of systems for which direct modeling of their dynamical evolution is difficult (for example, because not all orbital parameters for their subsystems are known). The last published version of the "Multiple-Star Catalog" of Tokovinin is analyzed to search for systems that may be unstable according to the two new criteria. More detailed studies are carried out for the HD 284419 (T Tau) system. The parameters of the apparent motion method is used to obtain new orbital solutions for this system. The regions of dynamical stability of the system as functions of the orbital parameters are estimated. It is not possible to determine a unique solution for the orbit with the available data; for periods shorter than 300 yr and longer than 5500 yr, the probability of decay of the system on time scales less than 10⁷ yr is high. This conclusion is supported by the application of the stability criteria, as well as direct modeling of the system's dynamical evolution. © Pleiades Publishing, Ltd., 2010.

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